

# **R309-550    Transmission and Distribution Pipelines (Effective August 15, 2001)**

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## **R309-550. Transmission and Distribution Pipelines.**

### ***R309-550-1. Purpose.***

The purpose of this rule is to provide specific requirements for the design and installation of transmission and distribution pipelines which are utilized to deliver culinary drinking water to facilities of public drinking water systems or to consumers. It is intended to be applied in conjunction with rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

### ***R309-550-2. Authority.***

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

### ***R309-550-3. Definitions.***

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

### ***R309-550-4. General.***

Transmission and distribution pipelines shall be designed, constructed and operated to convey adequate quantities of water at ample pressure, while maintaining water quality.

### ***R309-550-5. Water Main Design.***

#### **(1) Distribution System Pressure.**

The distribution system shall be designed to maintain a minimum pressure of 20 psi (at ground level) at all points of connection, under all conditions of flow, but especially during peak day flow conditions, including fire flows.

***Guidance: The normal working pressure in the distribution system should be between 40 and 60 psi. When static pressure exceed 80 psi, pressure reducing devices should be***

*provided on mains in the distribution system, or individual home pressure reducing valves should be installed per the Utah Plumbing Code.*

## **(2) Assumed Flow Rates.**

Flow rates to be assumed when designing or analyzing distribution systems shall be as given in R309-510 of these rules.

## **(3) Computerized Network Analysis.**

- (a) All water mains shall be sized after a hydraulic analysis based on flow demands and pressure requirements. If the calculations needed to conduct this hydraulic analysis are complex, a computerized network analysis shall be performed to verify that the distribution system will be capable of meeting the requirements of this rule.
- (b) Where improvements will upgrade more than 50% of an existing distribution system, or where a new distribution system is proposed, a hydraulic analysis of the entire system shall be prepared and submitted for review prior to plan approval.
- (c) In the analysis and design of water distribution systems, the following Hazen-William coefficients shall be used: PVC pipe = 140; Ductile Iron Pipe = 120; Cement-Mortar Lined Ductile Iron Pipe = 130 to 140.

## **(4) Minimum Water Main Size.**

For water mains not connected to fire hydrants, the minimum line size shall be 4-inch diameter. Minimum water main size serving a fire hydrant lateral shall be 8-inch diameter unless a hydraulic analysis indicates that required flow and pressures can be maintained by smaller lines.

*Guidance: Generally, velocity in a water main should not exceed 5 fps. Mains should be designed with sufficient excess capacity to provide for anticipated future connections.*

## **(5) Fire Protection.**

- (a) The design of the distribution system shall be consistent with Appendix III-A and III-B of the 1991 Uniform Fire Code. As specified in this code, minimum fire-flow requirements are:

(i) 1000 gpm for one- and two-family dwellings with an area of less than 3600 square feet.

(ii) 1500 gpm or greater for all other buildings.

(b) The location of fire hydrants shall be consistent with Appendix III-B of the 1991 Uniform Fire Code. As specified in this code, average spacing between hydrants must be no greater than 500 ft.

***Guidance: Generally, individual hydrant spacing may range from 350 to 600 feet depending on the area being served. Hydrants should be provided at each street intersection and at intermediate points between intersection. The planning of hydrant locations should be a cooperative effort between the water utility and local fire officials.***

(c) An exception to the fire protection requirements of (a) and (b) may be granted if a suitable statement is received from the local fire protection authority.

(d) Water mains not designed to carry fire flows shall not have fire hydrants connected to them.

(e) The design engineer shall verify that the pipe network design permits fire-flows to be met at representative locations while a minimum pressure of 20 psi is maintained at all times and at all points in the distribution system.

***Guidance: For guidance on conducting this analysis, refer to AWWA Manual M31, Distribution System Requirements for Fire Protection.***

(f) As a minimum, the flows to be assumed during a fire-flow analysis shall be the "peak day demand" plus the fire flow requirement.

***Guidance: See section 309-510-5 for information on how to estimate the "peak day demand" for various types of public water supplies.***

## **(6) Geologic Considerations.**

The character of the soil through which water mains are to be laid shall be considered. This information shall accompany any submittal for a pipeline project.

***Guidance: If possible, pipelines should not be laid in areas of unusual geologic hazard (e.g. slide zones, fault zones, etc.) Where these areas are impossible to avoid, special design and burial techniques should be employed. IN areas of high earthquake hazard, it is recommended that pipe be of a type least vulnerable to damage by earthquake, such as ductile-iron and PVC pipe.***

## **(7) Dead Ends.**

(a) In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical.

(b) Where dead-end mains occur, they shall be provided with a fire hydrant if flow and pressure are sufficient, or with an approved flushing hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows which will give a velocity of at least 2.5 fps in the water main being flushed. No flushing device shall be directly connected to any sewer.

## **(8) Valves.**

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500 foot intervals in commercial districts and at not more than one block or 800 foot intervals in other districts. Where systems serve widely scattered customers and where future development is not expected, the valve spacing shall not exceed one mile.

## **(9) Corrosive Soils.**

The design engineer shall consider the materials to be used when corrosive soils or waters will be encountered.

*Guidance: Where severe corrosion is indicated, approved plastic pipe is recommended.*

## **(10) Special Precautions in Areas of Groundwater Contamination by Organic Compounds.**

Where distribution systems are installed in areas of groundwater contaminated by organic compounds:

(a) pipe and joint materials which are not subject to permeation of the organic compounds shall be used.

(b) non-permeable materials shall be used for all portions of the system including water main, service connections and hydrants leads.

## **(11) Separation of Water Mains from Other Sources of Contamination.**

Design engineers shall exercise caution when locating water mains at or near certain sites such as sewage treatment plants or industrial complexes. Individual septic tanks shall be located and avoided. The engineer shall contact the Division to establish specific design requirements for locating water mains near any source of contamination.

## ***R309-550-6. Component Materials and Design.***

### **(1) NSF Standard for Health Effects.**

All materials which may contact drinking water, including pipes, gaskets, lubricants and O-Rings, shall be ANSI-certified as meeting the requirements of NSF Standard 61, Drinking Water System Components - Health Effects. To permit field-verification of this certification, all such components shall be appropriately stamped with the NSF logo.

### **(2) Restrictions on Asbestos and Lead.**

(a) The use of asbestos cement pipe shall not be allowed.

(b) Pipes and pipe fittings containing more than 8% lead shall not be used. Lead-tip gaskets shall not be used. Repairs to lead-joint pipe shall be made using alternative methods.

### **(3) AWWA Standards for Mechanical Properties.**

Pipe, joints, fittings, valves and fire hydrants shall conform to NSF Standard 61 or Standard 14, and applicable sections of ANSI/AWWA Standards C104-95 through C550-90 and C900-97 through C950-95.

### **(4) Used Materials.**

Only materials which have been used previously for conveying potable water may be reused. Used materials shall meet the above standards, be thoroughly cleaned, and be restored practically to their original condition.

### **(5) Fire Hydrant Design.**

***Guidance: Fire hydrants should have a bottom valve size of at least five inches, one 4.5 inch pumper nozzle and two 2.5 in nozzles.***

***Guidance: The hydrant lead should be a minimum of six inches in diameter. Auxiliary valves should be installed in all hydrant leads.***

Hydrant drains shall not be connected to or located within 10 feet of sanitary sewers or storm drains.

***Guidance: Hydrant drains should be plugged. When the drains are plugged, the barrels should be pumped dry after use during freezing weather. Where hydrant drains are not plugged, a gravel pocket or dry well should be provided unless the natural soils will provide adequate drainage.***

## **(6) Air Relief Valves.**

At high points in water mains where air can accumulate, provisions shall be made to remove air by means of hydrants or air relief valves. Automatic air relief valves shall not be used in situations where flooding may occur.

***Guidance: The air relief valve should be placed so as to prevent problems due to freezing. A shut-off valve should be provided to permit servicing of any air relief valve.***

(a) Air Relief Valve Vent Piping.- The open end of an air relief vent pipe from automatic valves shall, where possible as determined by public water system management, be extended to at least one foot above grade and provided with a screened (#14 mesh, non-corrodible) downward elbow. Alternately, the open end of the pipe may be extended to as little as one foot above the top of the pipe if the valve's chamber is not subject to flooding and provided with a drain-to-daylight (See (b) below). Blow-offs or air relief valves shall not be connected directly to any sewer.

(b) Chamber Drainage - Chambers, pits or manholes containing valves, blow-offs, meters, other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer. They shall be provided with a drain to daylight. Where this is not possible, underground gravel filled absorption pits may be used if the site is not subject to flooding and conditions will assure adequate drainage. Where a chamber contains an air relief valve, and it is not possible to provide a drain-to-daylight, the vent pipe from the valve shall be extended to at least one foot above grade (See (a) above). Only when it is both impossible to extend the vent pipe above grade, and impossible to provide a drain-to-daylight may a gravel filled sump be utilized to provide chamber drainage (assuming local ground conditions permit adequate drainage without ground water intrusion).

***Guidance: PVC Pipe Considerations. Consideration should be given to placing tracer tape on PVC pipe to permit location of the pipe by available detection equipment. Furthermore,***



*systems subject to severe freezing episodes should consider that a typical method for thawing pipe requires metal pipe.*

## **R309-550-7. Separation of Water Mains and Transmission Lines from Sewers and Other Pollution Sources.**

### **(1) Basic Separation Standards.**

The horizontal distance between pressure water mains and sanitary sewer lines shall be at least ten feet. Where a water main and a sewer line must cross, the water main shall be at least 18 inches above the sewer line. Separation distances shall be measured edge-to-edge (i.e. from the nearest edges of the facilities). Water mains and sewer lines shall not be installed in the same trench.

### **(2) Exceptions to Basic Separation Standards.**

Local conditions, such as available space, limited slope, existing structures, etc., may create a situation where there is no alternative but to install water mains or sewer lines at a distance less than that required by Subsection (1), above. Exceptions to the rule may be provided by the Executive Secretary if it can be shown that the granting of such an exception will not jeopardize the public health.

### **(3) Special Provisions.**

The following special provisions apply to all situations:

- (a) The basic separation standards are applicable under normal conditions for sewage collection lines and water distribution mains. More stringent requirements may be necessary if conditions such as high groundwater exist.
- (b) Sewer lines shall not be installed within 25 feet horizontally of a low head (5 psi or less pressure) water main.
- (c) Sewer lines shall not be installed within 50 feet horizontally of any transmission line segment which may become unpressurized.
- (d) New water mains and sewers shall be pressure tested where the conduits are located ten feet apart or less.
- (e) In the installation of water mains or sewer lines, measures shall be taken to prevent or minimize disturbances of the existing line.

(f) Special consideration shall be given to the selection of pipe materials if corrosive conditions are likely to exist. These conditions may be due to soil type and/or the nature of the fluid conveyed in the conduit, such as a septic sewage which produces corrosive hydrogen sulfide.

(g) Sewer Force Mains

(i) Sewer force mains shall not be installed within ten feet (horizontally) of a water main.

(ii) When a sewer force main must cross a water line, the crossing shall be as close as practical to the perpendicular. The sewer force main shall be at least 18 inches below the water line.

(iii) When a new sewer force main crosses under an existing water main, all portions of the sewer force main within ten feet (horizontally) of the water main shall be enclosed in a continuous sleeve.

(iv) When a new water main crosses over an existing sewer force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating.

#### **(4) Water Service Laterals Crossing Sewer Mains and Laterals.**

Water service laterals shall conform to all requirements given herein for the separation of water and sewer lines.

### ***R309-550-8. Installation of Water Mains.***

#### **(1) Standards.**

(a) The specifications shall incorporate the provisions of the manufacturer's recommended installation procedures or the following standards:

(i) AWWA Standard C600-99, Installation of Ductile Iron Water Mains and Their Appurtenances

(ii) ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping and PVC Pipe

(b) The provisions of the following publication shall be followed for PVC pipe design and installation:

PVC Pipe - Design and Installation, AWWA Manual M23, 1990, published by the American Water Works Association

## **(2) Bedding.**

A continuous and uniform bedding shall be provided in the trench for all buried pipe. Stones larger than the backfill materials described below shall be removed for a depth of at least six inches below the bottom of the pipe.

## **(3) Backfill.**

Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. The material and backfill zones shall be as specified by the standards referenced in Subsection (1), above. As a minimum:

- (a) For plastic pipe, backfill material with a maximum particle size of 3/4 inch shall be used to surround the pipe.
- (b) For ductile iron pipe, backfill material shall contain no stones larger than 2 inches.

## **(4) Dropping Pipe into Trench.**

Under no circumstances shall the pipe or accessories be dropped into the trench.

## **(5) Burial Cover.**

All water mains shall be covered with sufficient earth or other insulation to prevent freezing unless they are part of a non-community system that can be shut-down and drained during winter months when temperatures are below freezing.

***Guidance: Pipe should be buried at least 12 inches below maximum expected frost penetration. The following is a list of reported pipe burial depths in Utah which may serve as a guide in this respect:***

- (A) Logan - 5ft.***
- (B) Salt Lake City - 3.5 ft. (5 ft. in high benches)***
- (C) Alta/Snowbird - 6 ft. (7 ft. if under roadway)***
- (D) St. George - 3ft.***

- (E) Park City - 5ft. (7 ft. above 7000 ft. elevation)*
- (F) Richfield - 4 ft.*
- (G) Moab - 4 ft.*

## **(6) Thrust Blocking.**

All tees, bends, plugs and hydrants shall be provided with reaction blocking, tie rods or joints designed to prevent movement.

## **(7) Pressure and Leakage Testing.**

All types of installed pipe shall be pressure tested and leakage tested in accordance with AWWA Standard C600-99.

## **(8) Surface Water Crossings.**

*Guidance: Surface water crossings, whether over or under water, present special problems; the Division should be consulted before final plans are prepared.*

### **(a) Above Water Crossings**

The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.

### **(b) Underwater Crossings**

A minimum cover of two feet or greater, as local conditions may dictate, shall be provided over the pipe. When crossing water courses which are greater than 15 feet in width, the following shall be provided:

- (i) The pipe shall be of special construction, having restrained joints for any joints within the surface water course and flexible restrained joints at both edges of the water course.
- (ii) Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to flooding; and the valve nearest to the supply source shall be in a manhole.
- (iii) Permanent taps shall be made on each side of the valve within the manhole to allow insertion of testing equipment to determine leakage and for sampling purposes.

### **(9) Sealing Pipe Ends During Construction.**

The open ends of all pipeline under construction shall be covered and effectively sealed at the end of the day's work.

### **(10) Disinfecting Water Distribution Systems.**

All new water mains or appurtenances shall be disinfected in accordance with AWWA Standard C651-99. The specifications shall include detailed procedures for the adequate flushing, disinfection and microbiological testing of all water mains. On all new and extensive distribution system construction, evidence of satisfactory disinfection shall be provided to the Division. Samples for coliform analyses shall be collected after disinfection is complete and the system is refilled with potable water. A standard heterotrophic plate count is advisable. The use of water for culinary purposes shall not commence until the bacteriologic tests indicate the water to be free from contamination.

## ***R309-550-9. Cross Connections and Interconnections.***

### **(1) Physical Cross Connections.**

There shall be no physical cross connections between the distribution system and pipe, pumps, hydrants, or tanks which are supplied from, or which may be supplied or contaminated from, any source except as approved by the Executive Secretary.

### **(2) Recycled Water.**

Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the potable water supply.

### **(3) System Interconnects.**

The approval of the Executive Secretary shall be obtained for interconnections between different potable water supply systems.

## ***R309-550-10. Water Hauling.***

Water hauling is not an acceptable permanent method for culinary water distribution in community water systems. Proposals for water hauling shall be submitted to and approved by the Executive Secretary.

### **(1) Exceptions.**

The Executive Secretary may allow its use for non-community public water supplies if:

- (a) consumers could not otherwise be supplied with good quality drinking water, or
- (b) the nature of the development, or ground conditions, are such that the placement of a pipe distribution system is not justified.

### **(2) Emergencies.**

Hauling may also be necessary as a temporary means of providing culinary water in an emergency.

***Guidance: The guidelines for water hauling are contained in the bulletin entitled “Recommended Procedures for Hauling Culinary Water” available from the Division.***

## **R309-550-11. Service Connections and Plumbing.**

### **(1) Service Taps.**

Service taps shall be made so as to not jeopardize the sanitary quality of the system's water.

### **(2) Plumbing.**

- (a) Service lines shall be capped until used.
- (b) Water services and plumbing shall conform to the Utah Plumbing Code. Solders and flux containing more than 0.2% lead and pipe and pipe fittings containing more than 8% lead shall not be used.

### **(3) Individual Home Booster Pumps.**

Individual booster pumps shall not be allowed for any individual service from the public water supply mains. Exceptions to the rule may be provided by the Executive Secretary if it can be shown that the granting of such an exception will not jeopardize the public health.

*Guidance: Public water systems are responsible to adequately design and maintain their systems in order to deliver an adequate quantity of clean, safe drinking water to their customers while maintaining a minimum pressure of 20 psi at all times, including peak demands (see R309-102-11 and R309-550-5).*

*Public water systems are being required to develop and operate a program to protect their systems from backflow or backsiphonage. An individual home booster pump, if installed such that the suction side of the pump draws directly from the system's water main rather than through an intermediate holding tank, may reduce the pressure in the main to less than 20 psi (perhaps even creating a vacuum), thereby increasing the potential for contaminated water to enter the distribution system through any minor undetected leaks that may exist.*

*We cannot regulate the individual homeowner, but we do not want to encourage where there is no other acceptable alternative, but each public water system should review language included in their service agreements with customers and perhaps modify such as needed.*

### **(4) Service Lines.**

The portion of the service line under the control of the water supplier is considered to be part of the distribution system and shall comply with all requirements given herein.

### **(5) Service Meters and Building Service Line.**

Connections between the service meter and the home shall be in accordance with the Utah Plumbing Code.

*Guidance: Each service connection should be individually metered.*

### **(6) Allowable Connections.**

All dwellings or other facilities connected to a public water supply shall be in conformance with the Utah Plumbing Code.

## **R309-550-12. Transmission Lines.**

### **(1) Unpressurized Flows.**

Transmission lines shall conform to all applicable requirements in this rule.  
Transmission line design shall minimize unpressurized flows.

*Guidance: Unpressurized flow makes the transmission line more vulnerable to contamination from surface water or shallow ground water.*

### **(2) Proximity to Concentrated Sources of Pollution.**

A water supplier shall not route an unpressurized transmission line any closer than fifty feet to any concentrated source of pollution (i.e. septic tanks and drain fields, garbage dumps, pit privies, sewer lines, feed lots, etc.). Furthermore, unpressurized transmission lines shall not be placed in boggy areas or areas subject to the ponding of water.

### **(3) Exceptions.**

Where the water supplier cannot obtain a fifty foot separation distance from concentrated sources of pollution, it is permitted to use a Class 50 ductile iron pipe with joints acceptable to the Executive Secretary. Reasonable assurance must be provided to assure that contamination will not be able to enter the unpressurized pipeline.

*Guidance: To assure continued protection of the transmission line, the water supplier should obtain a fifty foot right-of-way on each side of the transmission line.*

*Guidance: Water supply conduits and major service lines crossing known fault areas should be either designed to accommodate significant differential movement of the ground or be valued immediately above and below the points of fault crossing to allow control of water flow in case of pipe rupture during an earthquake event.*

*Guidance: Water supply systems which receive their supply from more than one source should be designed to provide alternative flow paths for major conduits in regions of known faults or, if such is not possible, that parallel routing of major conduits be avoided.*

## **R309-550-13. Operation and Maintenance.**



### **(1) Disinfection After Line Repair.**

The disinfection procedures of Section 4.7, AWWA Standard C651-99 shall be followed if any water main is cut into or repaired.

### **(2) Cross Connections.**

The water supplier shall not allow a connection which may jeopardize water quality. Cross connections are not allowed unless controlled by an approved and properly operating backflow prevention assembly. The requirements of the Utah Plumbing Code shall be met with respect to cross connection control and backflow prevention.

Suppliers shall maintain an inventory of each pressure vacuum breaker assembly, spill-resistant vacuum breaker assembly, double check valve assembly, reduced pressure principle backflow prevention assembly, and high hazard air gap used by their customers, and a service/inspection record for each such assembly.

Backflow prevention assemblies shall be inspected and tested at least once a year, by an individual certified for such work. This responsibility may be borne by the water system or the water system management may require that the customer having the backflow prevention assembly be responsible for having the device tested.

Suppliers serving areas also served by a pressurized irrigation system shall prevent cross connections between the two. Requirements for pressurized irrigation systems are outlined in Section 19-4-112 of the Utah Code.

### **(3) NSF Standards.**

All pipe and fittings used in routine operation and maintenance shall be ANSI-certified as meeting NSF Standard 61 or Standard 14.

### **(4) Seasonal Operation.**

Water systems operated seasonally shall be disinfected and flushed according to the techniques given in AWWA Standard C651-99 for pipelines and AWWA Standard C652-92 for storage facilities prior to each season's use. A satisfactory bacteriologic sample shall be achieved prior to use. During the non-use period, care shall be taken to close all openings into the system.

### ***Guidance: Emergencies***

*Water systems in areas subject to high earthquake hazard are encouraged to develop contingency plans for obtaining pipe and appurtenances in an emergency. The stockpiling of material should be considered.*

*Guidance: Operation and Maintenance Procedures Requiring Plan Approval.*

*Refer to Subsection R309-500-5 to determine under what circumstances a pipeline repair or replacement procedure shall be pre-approved by the Division.*

**KEY: drinking water, transmission and distribution pipelines, connections, water hauling**

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